

Examiner's helpful comments. Withdrawal of the rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

II. Claims 1-7 Define Patentable Subject Matter

The Office Action rejects claims 1-3, 5 and 6 under 35 U.S.C. §103(a) over U.S. Patent 5,558,718 to Leung in view of Japanese Patent JP 08-299785 A to Nawata *et al.* (Nawata). The Office Action further rejects claims 1-7 under 35 U.S.C. §103(a) over U.S. Patent 5,795,452 to Kinoshita *et al.* (Kinoshita) in view of Leung. These rejections are respectfully traversed.

Leung, Nawata and Kinoshita, alone or in any combination, do not teach or suggest a plasma processing apparatus provided with an inductive coupled electrode for generating plasma in a vacuum processing chamber, wherein the electrode is formed by a conductive line-shaped member whose total length is substantially equal to a wavelength of a supplied high frequency power, and is formed so that one end of the electrode is grounded and another end thereof is connected to a high frequency power source for supplying the high frequency power, a standing wave of one wavelength is produced along the electrode when the high frequency power source supplies the high frequency power to the electrode, a node of the standing wave produced along the electrode is formed at a central portion of the electrode, and an antinode of the standing wave is formed on both portions respectively corresponding to a half portion of the electrode, which exist at both sides of the center point, as recited in claim 1.

Instead, Leung discloses a vacuum chamber having a pulsed plasma source 10. Leung further teaches the pulse plasma source 10 as having a partially coil shape arranged around the target object 11 placed inside the chamber walls 14. A pulse current is supplied into the pulsed plasma source 10 from the RF pulse circuit to expose the target object 11 to

the plasma in a pulse mode. See col. 5, lines 2-32 and Fig. 2C of Leung. The Office Action associates an "electrode 10" as the pulse plasma source 10 of Leung.

Because the pulse plasma source 10 shown in Leung is not grounded, the Office Action also applies Nawata as an additional reference. Applicants assert that Nawata fails to compensate for the deficiencies of Leung for Applicants' claim 1, and also does not disclose the additional features in Applicants' dependent claims 2, 3, 5 and 6.

Nawata discloses a discharge reactor. The Office Action asserts that the plasma processing apparatus of Nawata has a plurality of electrodes, that these electrodes are connected to the RF power source, and that the ends of the electrodes are grounded. Applicants respectfully disagree, and assert that the discharge reactor in Nawata merely shows just parallel-planar electrode structure.

Further, there is no motivation to combine features related to the ion implantation apparatus of Leung with the discharge reactor of Nawata, nor has the Office Action established sufficient motivation or a *prima facie* case of obviousness. Even assuming that motivation to combine Leung and Nawata is established, the combination fails to teach or suggest Applicants' claimed features.

Kinoshita does not compensate for the deficiencies of Leung outlined above for claim 1. Nor does Kinoshita teach, disclose or suggest the additional features recited in claims 2-7. Instead, Kinoshita discloses a dry process system having a chamber 1 with reaction gas 4. In particular, Kinoshita teaches at least one pair of planar electrodes 21, 22 arranged inside the chamber 1 in parallel. A substrate 3 is loaded on the electrodes that are supplied with an alternating current power source 6 through a predetermined electric element, *e.g.*, a blocking capacitor 7 and a means for applying one or more magnetic fields 21. See col. 5, lines 46-62 and Fig. 1 of Kinoshita. Applicants assert that Kinoshita merely shows a structure forming the layered parallel-planar electrodes.

The subject matter defined by Applicants' claims 1-7 relates to a plasma processing apparatus based on the plasma CVD for uniformly depositing the amorphous thin film onto the large-area rectangular substrate etc. using the inductive coupled electrode in order to make a solar cell. The claimed features recite that the electrodes arranged in the chamber is formed by bending the conductive wire or the conductive line-shaped member back at its central portion to make a substantially U-shape member. See, *e.g.*, page 12 of the specification and Figs. 4 and 5. The electrodes having such a characteristic shape are arranged at the predetermined arrangement to the substrate conveyed in the chamber, and the predetermined high frequency power is supplied to the electrodes from the high frequency power source in order to produce the standing wave with the predetermined pattern along each of the electrodes. These features are not taught or suggested by any of the applied references.

Further, there is no motivation to combine features related to the dry process system of Kinoshita with the ion implantation apparatus of Leung, nor has the Office Action established sufficient motivation or a *prima facie* case of obviousness. Even assuming that motivation to combine Kinoshita and Leung is established, the combination fails to teach or suggest Applicants' claimed features.

For at least these reasons, Applicants respectfully assert that claim 1 is now patentable over the applied references. The claims depending from claim 1 are likewise patentable over the applied references for at least the reasons discussed as well as for the additional features they recite. Consequently, all the claims are in condition for allowance. Thus, Applicants respectfully request that the rejections under 35 U.S.C. §103 be withdrawn.

III. Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,



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Attachment:
Appendix

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<p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 15-0461</p>
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APPENDIX

Changes to Specification:

The following is a marked-up version of the amended paragraphs:

Page 17, lines 3-20:

In other words, the shape and ~~dimensions~~ dimensions of the electrode 12 is designed and the frequency of the high frequency power supplied to the electrode 12 is determined so that the standing waves are positively created having, for example, one antinode at each of the two parallel straight portions of the electrode 12. Further, when supplying the high frequency power from the high frequency power generator 13 to the U-shaped electrode 12, one end 12b is made to be the feeding point and the other end 12c is connected to the ground. By doing this, the standing wave of one wavelength is generated on the electrode 12 with controlled standing waves generated at the two straight portions of the electrode 12. In the standing waves of the half wavelength generated at each of the two straight portions of the U-shaped electrode 12, their antinodes are consistent in their positions and they mutually intensifies at the region between the straight portions. As a result, plasma with a uniform density is generated in the region between the two straight portions of the electrode 12 and in the surrounding regions.

Page 20, lines 14-21:

According to the above embodiment, ~~since~~ because an inductive coupling type electrode is used, there is the advantage that the plasma density can easily be raised compared with a capacitive coupling type electrode. Further, by making the electrode U-shaped and using one of the ends of the electrode as the feeding point, due to the interaction of the standing waves produced at the two bent back straight portions, the plasma is ~~strengthened~~ strengthened and the density of the plasma can be kept from becoming nonuniform.

Changes to Claims:

The following is a marked-up version of the amended claims:

1. (Amended) In a plasma processing apparatus ~~of an internal electrode type,~~
~~which is~~ provided with an inductive-coupling-type coupled electrode for generating plasma in
a vacuum processing chamber, the plasma processing apparatus ~~characterized in that~~ wherein:
said electrode is formed ~~so that a~~ by a conductive line-shaped member whose
total length ~~of said electrode~~ is substantially equal to ~~an excitation~~ wavelength of a supplied
high frequency power, and is formed so that;

one end of said electrode is grounded and another end thereof is connected to a
high frequency power source for supplying said high frequency power, and a standing wave
of one wavelength is produced along said electrode when said high frequency power source
supplies a said high frequency power to said electrode; and

a node of said standing wave produced along said electrode is formed at a
central portion of said electrode, and an antinode of said standing wave is formed on both
portions respectively corresponding to a half portion of said electrode, which existing at both
sides of said center point.

2. (Amended) A plasma processing apparatus ~~of an internal electrode type~~ as set
forth in claim 1, ~~characterized in that~~ wherein said electrode is formed to be U-shaped by
bending ~~it~~ said electrode back at said central portion, and each of the half portions of said
electrode corresponds to a straight portion, and both of the half portions are arranged in
parallel.

3. (Amended) A plasma processing apparatus ~~of an internal electrode type~~ as set
forth in claim 1, ~~characterized in that~~ wherein a length of the half portion of said electrode is
substantially equal to a half of the wavelength of said high frequency power.

4. (Amended) A plasma processing apparatus ~~of an internal electrode type~~ as set
forth in claim 1, ~~characterized in that~~ wherein a plurality of said electrodes are arranged to

make a stratified structure comprising a plurality of layers within said vacuum processing chamber, a plurality of film depositing regions are produced using a space between said electrodes included in said plurality of layers, and film deposition on a substrate is performed in each of said plurality of film depositing regions.

5. (Amended) ~~In a plasma processing apparatus of an internal electrode type, which is provided with an inductive-coupling type coupled electrode for generating plasma in a vacuum processing chamber, the plasma processing apparatus characterized in that wherein:~~

~~said electrode is formed so that a~~ by a conductive line-shaped member whose total length of said electrode is determined to natural number times of a half of an excitation wavelength of a supplied high frequency power, and is formed so that;

_____ one end of said electrode is grounded and another end thereof is connected to a high frequency power source for supplying said high frequency power, and standing waves are produced along said electrode when said high frequency power source supplies a said high frequency to said electrode; and

a node of said standing waves produced along said electrode is formed at a central portion of said electrode, and at least one antinode of said standing waves is formed on both portions respectively corresponding to a half portion of said electrode, which existing at both sides of said center point.

6. (Amended) ~~A plasma processing apparatus of an internal electrode type as set forth in claim 5, characterized in that wherein~~ said electrode is formed to be U-shaped by bending ~~it~~ said electrode back at said central portion, and each of the half portions of said electrode is a straight portion, both of the half portions are arranged in parallel, and said node of said standing wave is consistent with a bending back point.

7. (Amended) ~~A plasma processing apparatus of an internal electrode type as set forth in claim 5, characterized in that wherein~~ a plurality of said electrodes are arranged to

make a stratified structure comprising a plurality of layers within said vacuum processing chamber, a plurality of film depositing regions are produced using a space between said electrodes included in said plurality of layers, and film deposition on a substrate is performed in each of said plurality of film depositing regions.